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AFEX: an autonomous freight exchange concept

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Abstract

The more efficient configuration and coordination of multimodal transports is a topic consistently emerging in the last decades. Several projects, like e.g. LOGFOR, CODE24 and CENTRAL EUROPE, make efforts to achieve progress in this area. This paper presents an already implemented and tested software prototype for the configuration of multimodal supply chains and describes how this prototype, which emerged from the CODE24 project, is able to facilitate contact between potential business partners and it is shown how the implementation of the prototype and the research into freight exchanges led the authors of this paper to a new market place concept: AFEX – Agent-based Freight Exchanges. It is shown how these yet to be implemented, highly automated and interconnected market places will alleviate problems commonly associated with existing market places and provide support for decentralized and autonomous software agents to perform contractually binding auctions of multimodal freight transport services utilizing a double-sided combinatorial auction model. Finally, an outlook on prospective concepts which support the negotiation of contracts for multimodal transport services using multi-agent systems is given.

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Keywords: intermodal transports; online freight exchange; logistics modelling; multi-agent systems; combinatorial auctions

1. An overview of online freight exchanges

The lasting internationalization of freight traffics leads to the decade-long search in logistics for a way to organize transports and their mediation more efficiently and sustainably. An idea emerging in this context time and again is the more efficient configuration and coordination of transport chains with the help of freight exchanges.

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Freight exchanges are market places where offers for and demands after transport services find one another. Contrary to forwarders, which constitute the classic form of freight mediation, they themselves are no participants of the processing of transport services. They merely mediate transport services, regularly combined with freights or freight space, between shippers and carriers. Since their origination in the 1970s and 1980s the freight exchanges processed this umpiring primarily via the media telephone, telefax and BTX. The majority of the companies specializes in the mediation of truck freights. By contrast, multimodal transports are being mediated fewest of all [23]. With the advent of the internet in the 1990s and 2000s the rise of e-commerce platforms provided a greater range for customer acquisition. This development opened up new sales channels and markets and provided a more transparent and comprehensive offer for demanders.

2. Establishment of an online freight exchange within the framework of CODE24

In the year 2010 the multinational joint project CODE24 has been started within the framework of the INTERREG-IVB-NWE program of the European Union. For an overview of the project it is being referred to [4]. The primary goal of the joint project consists in the integration and advancement of the activities on the trans-European transport axis no. 24 in order to strengthen sustainably the rail freight traffic in Europe. This "Corridor 24" is not only the main railroad line through the Swiss Alps, but connects the harbors of Rotterdam and Genoa. The challenges here are manifold: Comprehensive and publicly accessible information on how many freight trains will use the corridor is currently missing. It is also uncertain how much this capacity can be improved through a higher utilization of the existing infrastructure. Finally, a considerable market non-transparency exists for forwarders that take a transport of their freight by rail into consideration, especially regarding the connection possibilities to freight transports in pre-carriage and on-carriage by means of trucks as well as inland or maritime vessels [12].

A central component of the work package 3 "freight transport and logistics" of the project CODE24 is the conception and implementation of an online freight exchange [11]. The Institute for Production and Industrial Information Management of the University Duisburg-Essen at first systematically ascertained the requirements of the essential logistical actors for an online rail freight exchange through the analyses of the relevant literature as well as interviews and workshops with industry experts [5, 17, 21]. Further analyses of user requirements were contributed by project partners of the institute [10, 12]. One of the most important conclusions was that a freight exchange which is one-sidedly tailored for the rail freight traffic has no realistic market potential. Detailed market analyses show that no such online freight exchange could establish itself on the European transport market in the long term [21]. Especially the transport carrier road has to be involved in order to be able to exhaust the potential of multimodal transport chains. The following elaborations provide a rough overview of the subsequently implemented software prototype ORFE ("online rail freight exchange") in its final version. It is elaborated in detail on the concept development in [8] and on the software development in [15].

Figure 1 shows an exemplary screenshot of the software prototype with an overview in which registered companies can choose from all advertisements of transport offers. All companies can register with ORFE in several different company categories, like e.g. as "forwarder" or as "railway forwarder". Companies thus receive the possibility to restrict the visibility of their advertisements to specific company categories.

It was agreed upon in the CODE24 project consortium that after the conceptualization and prototypical implementation of ORFE, the final prototype would have to be refined and reimplemented into a commercial software product. On the first steps of this developmental works it is being commented in [10].

With regard to the management concept to be developed it was very important for all questioned project partners and also for other interviewed experts that the future operator of the online freight exchange ORFE behaves in an economically impartial way towards all exchange users [10, 21]. The authors got the impression from various expert interviews and also from other sector specific research projects that the sector of the rail freight traffic is being characterized by a high intensity of competition and mutual distrust. Numerous market actors doubt that an operator can be found inside the industry that acts "truly" impartially. Industry outsiders, on the other hand, are often denied the competence to run an online freight exchange economically successfully.